

2. SUMMARY AND CONCLUSION

The Relativistic Heavy Ion Collider was designated a “Low Hazard” facility by the Program Secretarial Officer of the DOE Office of Science. Routine and abnormal operations will result in minimal onsite and negligible offsite consequences. The maximum dose equivalent to a member of the offsite public is less than 1 mrem per year from all sources for both normal and abnormal conditions. The design of the facility has given consideration to achieve as close to zero environmental impact as reasonably achievable.

The safety analysis assumed an upgraded Collider with the equivalent of 2.25×10^{11} Au ions per ring, which is 4 times the design basis beam intensity. In addition, for the purpose of design, the radiological analysis assumed 2 times the Quality Factor for neutrons. Thus, significant safety margins exist in the shielding calculations and dose projections in conjunction with allowance for future upgrades to the Collider.

The Design Basis Accident assumed for the Collider involved an accidental loss of one of the circulating beams at full energy. This will result in less than 160 mrem/fault to a small area on top of the berm. The expected rate of such faults is small, at most once in ten years, based on actual experience with a similar machine, the Tevetron at Fermilab. The Worst Case Accident with beam from the RHIC injection system (that is not considered credible) requires a combination of 5 concurrent hardware and administrative failures. Nonetheless, because the AGS can deliver proton beams at injection intensity approximately 20 times greater than that required by RHIC, a safety system to monitor the AGS proton intensity during injection or an equivalent Lockout/Tagout for Radiation Safety will be deployed. If beam current monitors are used, they will be redundant safety grade beam instrumentation to measure the beam in the AGS Ring prior to extraction. They will independently prevent beam intensity greater than the RHIC Design Intensity from being accelerated in the AGS Ring when the AGS to RHIC Transfer Line is enabled, thereby keeping the Transfer Line and Collider safe from even a single full intensity AGS beam pulse.

The Cryogenic System was designed in compliance with the ASME Boiler and Pressure Vessel Code and was analyzed by a Failure Modes and Effect Analysis. There is a very small

probability of fatality ($<10^{-7}/\text{hr}$) due to accidental release of helium gas in Collider tunnel. The Refrigerator Building has slightly higher risk of helium release such that more stringent access controls and worker training is required for that location. There is no hazard to the public from a release of helium gas, nor is there a possibility the helium gas can be radioactive either in use or upon release.

The volume of radioactive waste generation, both liquid and solid, is expected to be in small quantities due to the nature of beam loss in a superconducting collider. No large volume of other hazardous waste types are expected beyond the routine use of solvents for cleaning and incidental use of other chemicals.

Common industrial type hazards exist throughout the complex that pose occupational risks to workers but not the public; i.e., electrical power usage, material handling, experimental systems using flammable gas, noise, etc.